

A New Species of *Chionographis* (*Melanthiaceae*) from Japan

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(Accepted on September 1, 2012)

A new species of the genus *Chionographis* was found in the Kii Peninsula located in the southwestern Pacific side of Honshu, Japan. It was named *C. cordifolia* and described with illustrations. The new species is characterized by the remarkably small habit, small cordate or subcordate leaf-blades, relatively small scaly leaves on the peduncle, six short narrowly spatulate tepals of which the two lower ones are approximately half to nearly as long as the four upper ones, and small reniform, perfectly unilocular anthers. The individual plants are normally andromonoecious or hermaphrodite. This species occurs only in a very small region of the Peninsula.

Key words: Andromonoecism, *Chionographis cordifolia*, *Chionographis hisauchiana*, *Chionographis japonica*, *Chionographis koidzumiana*, hermaphroditism, Japan, new species.

The genus *Chionographis* Maxim. consists of about five species and is distributed in southern China, Japan and southern Korea (Hara 1968, Chen 1980, Tanaka 2003, Huang et al. 2011). Three species in Japan occur; *C. japonica* (Willd.) Maxim. (Maximowicz 1867), *C. koidzumiana* Ohwi (Ohwi 1930) and *C. hisauchiana* (Okuyama) N. Tanaka (Tanaka 2003).

In the course of reviewing the Japanese members of *Chionographis*, several specimens from the Kii Peninsula, southwestern Honshu, were found to have very unusual features and disagree with any of the known species. They have hitherto been identified as *C. japonica* or *C. koidzumiana*.

After a close survey, the specimens proved to be a new species. This novelty will be described and illustrated here with some relevant taxonomic records and notes.

Chionographis cordifolia N. Tanaka, sp. nov. [Figs. 1, 2]

Haec species nova a speciebus ceteris *Chionographidis* habitu parvulo, laminis parvis cordatis subcordatisve plerumque usque ad 1.5 cm longis, tepalis albis brevissimis (ad 3.8 mm longis) anguste spatulatis sex, quorum duobus inferioribus quam quattuor superioribus paulo brevioribus (ad ca. 1/2) vel eis fere aequantibus, antheris reniformibus perfecte unilocularibusque ad 0.3 mm longis, 0.5 mm latis, seminibus cum testa apice distali acuta vel breviter caudata, facile distinguitur.

Planta plerumque mense Junio florens, andromonoecia vel hermaphroditica, interdum mascula; in montibus Kii-peninsulae Japoniae indigena.

Type: JAPAN. Honshu. The Kii Peninsula. Mie Pref. Hinodedake – Momonoki, Ōsugidani, edge of the forests with moderate humidity,



Fig. 1. Four individuals of *Chionographis cordifolia* N. Tanaka at late anthesis to early fruitage from Mie Pref., the Kii Peninsula (Satomi 878, KANA 12010).

alt. 800 m, 4 June 1973, fl., T. Yamazaki, F. Yamazaki, M. Sugiyama & T. Morita s.n. (TI-holotype).

Herb small, glabrous, perennial, sexually andromonoecious or hermaphrodite, sometimes male. Rhizome ascending, subterete, often curved, with scars of withered leaves, slender,

to 15 mm long, to 2.5 mm in diameter. Roots filiform, to ca. 0.3 mm in diameter. Leaves 5–14, evergreen, rosulate, to 5.5 cm long including petiole; blade cordate, ovate or deltoid-ovate; base cordate or subcordate, rarely rounded; apex acute or subacute, sometimes obtuse; margin markedly crisped; 6–15(–18) mm long,

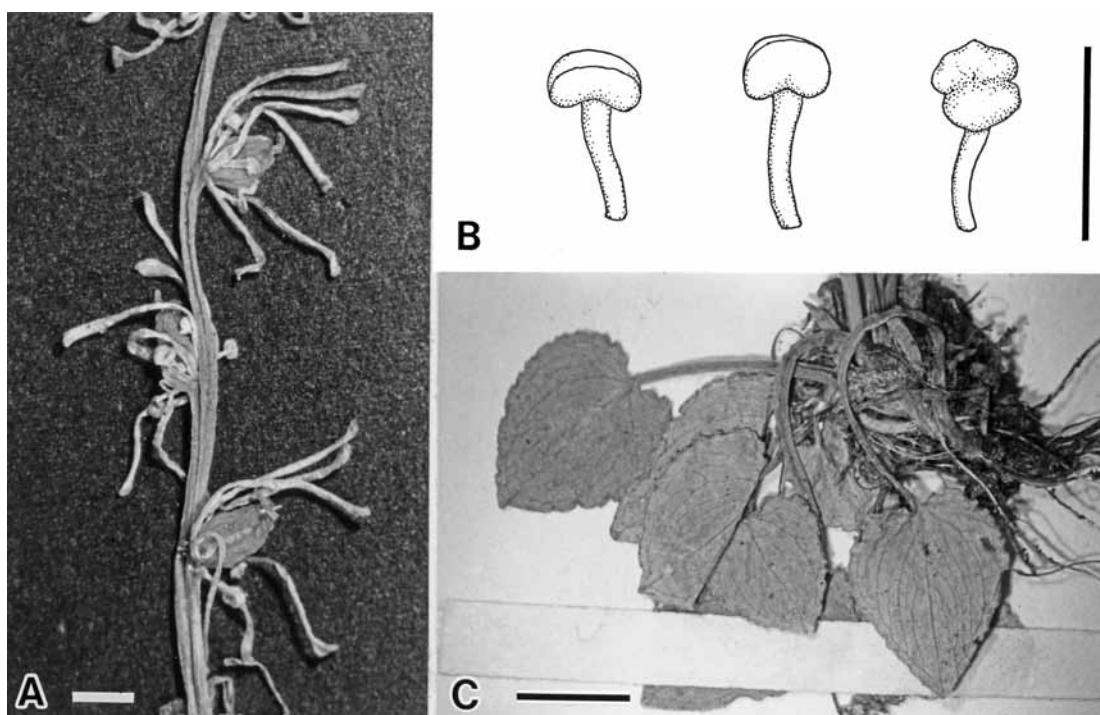


Fig. 2. *Chionographis cordifolia* N. Tanaka. A. Part of spike bearing flowers with 6 tepals of nearly equal length (7 July 1984, Tanaka s.n., TEU). Scale bar = 1 mm. B. Drawings of three stamens with perfectly unilocular anther (7 July 1984, Tanaka s.n., TEU). Left and middle stamens with closed anther cell. Right stamen with fully dehisced anther cell. Scale bar = 1 mm. C. Basal part of plant bearing cordate leaves (Satomi 878, KANA 12010). Scale bar = 5 mm.

5–10.5 mm wide; petiole slender, adaxially sulcate and narrowly alate at margin, abaxially keeled, 0.7–3.7 cm long, 0.5–0.7 mm wide (in middle part), slightly dilated toward base. Floriferous stem erect, 13–14 cm long including inflorescence rachis (in fruit elongated to ca. 25 cm long), 0.5–0.6 mm in diameter; peduncle (or leafy scape) in fruit to ca. 20 cm long, to 1.2 mm in diameter, with a few longitudinal angles or narrowly winged; cauline scaly leaves on peduncle 4–7, narrowly lanceolate, narrowly elliptic, or subulate, to 12(–16) mm long, to 2.5(–3.5) mm wide; rachis of inflorescence 6–10 mm long, with a few longitudinal ribs, elongated to 5.3 cm in fruit. Inflorescence a terminal spike with 6–10(–17) flowers including abortive ones; male or abortive flowers usually borne at distal and/or most proximal portion in case of andromonoecious spike. Flowers sessile,

becoming shortly pedicellate in fruit, ebracteate, hermaphrodite or male, slightly zygomorphic; tepals 6, narrowly spatulate, white; the 4 upper tepals, (2.2–)3–3.8 mm long, 0.2–0.4 mm wide at distal widest point; the 2 lower tepals (1.2–)1.5–3.5 mm long. Stamens 6; filaments narrowly subterete, 0.3–0.8(–1.2) mm long, 0.1–0.2 mm wide; anthers reniform, perfectly unilocular, 0.2–0.3 mm long, 0.3–0.5 mm wide; pollen pale cream. Pistil 1; ovary ellipsoid, 0.5–0.6 mm long; in fruit becoming antrorse, ovoid, trisulcate, 2.5–4.3 mm long; styles 3, narrowly oblong, recurved, to 0.6 mm long, ventrally stigmatic. Ovules 2 per ovarian locule, collateral on marginal placentae; slightly immature seed narrowly (sub)ellipsoïdal, 2.3 mm long, brown, coated with white scarious testa acutely projecting distally, 3.7 mm long.

Flowering period: Late May to early July,

Table 1. Some sexual reproductive characters of *Chionographis cordifolia* based on herbarium specimens*

Total no. of spikes (plants) examined	Total no. of herm. spikes** (%)	Total no. of andr. spikes** (%)	Total no. of fls** per spike	Ratio (%) of herm. fls per spike**	Ratio (%) of fls with ripening ovary (to total herm. fls)
N = 25 (22)	6 (24.0)	19 (76.0)	M = 9.1 RV: 6–17 SD = 2.2	M = 79.6 RV: 55.6–100.0 SD = 13.2	ca. 100

*Specimens preserved at KANA, KYO and TEU. For more details see the text.

**Abortive flowers when present included.

Abbreviations. andr.: andromonoecious. fls: flowers. herm: hermaphrodite. M: mean. N: total number of samples. no.: number. R V: range of variation. SD: standard deviation.

with the peak in early to mid June.

Habitat: On moist rocky or gravelly slopes near stream at edges of forests, 400–1500 m in elevation.

Distribution: Japan, Honshû, the Kii Peninsula (Nara and Mie Prefectures).

Etymology: The specific epithet refers to the shape of the leaves.

Japanese name: Kii-hime-shiraitosô (nov.).

新和名：キイヒメシライトイソウ（紀伊姫白糸草）

Other specimens of *Chionographis cordifolia* examined. JAPAN. Honshu. Kii Peninsula. **Mie Pref.**: [Taki-gun, Ôdai-cho] Ôdaigahara-yama; Ôdai-goya – Hinode-dake – Ôsugi-dani, 5 Jul. 1952, (fl.)fr., N. Satomi 878 (KANA 12010); en route from Momonokigoya to Dokuranotaki, in Ôsugi-dani, 16 Jul. 1957, (fl.)fr., M. Tagawa & K. Iwatsuki 1725 (JKYO); Ôsugi-dani, 7 Jul. 1984, (fl.)fr., N. Tanaka s.n. (TEU). **Nara Pref.** (Prov. Yamato): [Yoshino-gun, Kamikitayama-mura] Mt. Ôdaigahara, alt. 1500 m, 23 Aug. 1956, fr., G. Murata 10144, p.p. (JKYO).

Note: *Chionographis cordifolia* has very small cordate or subcordate leaf-blades, which contrastingly differ from usually ovate, elliptic, lanceolate or oblanceolate blades with an attenuate or a rounded base of all other congeners including Chinese species (Krause 1929, Hara 1968, Chen 1980, Huang et al. 2011). This new species has an ovoid fruit. This agrees with the other Japanese species, but disagrees with Chinese ones which have an obovoid or subobovoid fruit (capsule) (Hara 1968, Huang et al. 2011).

Chionographis cordifolia differs from other Japanese species in having six tepals of which the two lower ones are often nearly as

long as the four upper ones. In *C. hisauchiana*, the two lower tepals are always present as in *C. cordifolia*, but usually about half as long as the four upper ones. In *C. japonica* and *C. koidzumiana*, the two lower tepals are usually vestigial and often lacking. From an evolutionary point of view, having six tepals of nearly equal length is considered to be more ancestral than having fewer or six tepals of more unequal length. In this view, *C. cordifolia* is regarded as having a more ancestral character state as to the tepal than any other Japanese species with more strongly unequal tepals. This implies the ancestral lineage of *C. cordifolia* was separated at a very early stage of diversification from those of the other Japanese species.

Meanwhile, *Chionographis cordifolia* has features of both *C. japonica* s.str. (e.g., narrowly spathulate tepals) and *C. koidzumiana* s.str. (e.g., unilocular anthers), but at the same time it has distinct features such as cordate or subcordate leaf-blades and six slightly subequal tepals. These facts may indicate that *C. cordifolia* is not such a hybrid as was produced between the two species as existing today, just inheriting their parental characters as they are.

Some observations on the sexual reproductive characters of *Chionographis cordifolia* were made based principally on herbarium specimens kept at KANA (Satomi 878, of which the three individuals out of four examined), KYO (Tagawa & Iwatsuki 1725 and G. Murata 10144, of which the nine individuals in total examined) and TEU (N. Tanaka s.n., whose 10 spikes

from as many individuals examined) (Table 1). Most flowers of these specimens were fruiting, but their sexual trait could be judged from the persistent floral parts. In 25 spikes from the 22 individuals examined (of which the three individuals had two spikes each), the number of flowers (including abortive ones) composing a single spike varied from 6 to 17 with the average of 9.1 (standard deviation 2.2). Of the total of 227 flowers from the 25 spikes, 179 flowers (78.9%) were hermaphrodite, 48 (21.1%) being either male or abortive. Of the 25 spikes, six spikes (24.0%) had hermaphrodite flowers and sometimes abortive ones also, and the rest 19 spikes (76.0%) bore hermaphrodite, male and occasionally abortive flowers. The percentage of hermaphrodite flowers to all the flowers making up a single spike ranged from 55.6 to 100% with the average of 79.6% (standard deviation 13.2; spikes examined 25). One living plant formerly cultivated at our nursery garden once had a very stunted flowering stem (ca. 5 cm tall) with a spike of five male flowers and an abortive one. This implies that male flowers, rather than hermaphrodite ones, tend to be produced when a plant is physiologically in poor condition. The tendency basically similar to this is observed rather universally in *C. japonica* and *C. hisauchiana* (Tanaka 1985, *C. hisauchiana* as three varieties of *C. japonica*; Maki 1993, in *C. japonica* var. *kurohimensis*, which composes a part of *C. hisauchiana*). No female individual was observed. So the individuals of *C. cordifolia* are normally andromonoecious or hermaphrodite. This sexual trait is similar to that known for *C. japonica* (Yatabe 1893, Iinuma and Makino 1907, Hara 1968, Tanaka 1985, 2003, Maki 1992). Most ovaries of the hermaphrodite flowers were observed to be fruiting, the fruitage being estimated to be ca. 100%. This high fruitage might indicate that the plants are self-compatible. Experiments to test this possibility are needed to ascertain the breeding system of this species.

Judging from the very restricted distribution

and some unique characters it bears, *Chionographis cordifolia* must be a relict species. It is hence eagerly hoped that the plants and their habitats will properly be protected from any endangering factors.

In one of the localities of *Chionographis cordifolia*, another congener appears to occur nearby. At Mt. Ōdaigahara in the Kii Peninsula, two individuals of this genus were collected on the same date by G. Murata (no. 10144, 23 Aug. 1956) and mounted together on a single herbarium sheet (KYO); one represents *C. cordifolia*, while the other a small form of *C. japonica*. This form was also collected at the same locality by H. Koidzumi (TNS 316277, 316278, cited below). Both species are small and look alike at first sight, but the small form of *C. japonica* is distinguishable from *C. cordifolia* by its larger lanceolate leaf-blades up to 3 cm long, slightly later-blooming flowers of which the two lower tepals are rather obsolete, and by the bilocular or semi-bilocular anthers (the anthers appear to be sometimes partially confluent at the apex between the thecae).

Specimens of *Chionographis japonica* examined and cited in this paper. JAPAN. Honshu. Kii Peninsula. Nara Pref. (Prov. Yamato): Yoshino-gun, Mt. Odaigahara, 25 July 1935, H. Koidzumi 99237, 99238 (TNS 316277, 316278).

I express my sincere gratitude to Drs. Hiroshi Ikeda at TI, Yuichi Kadota at TNS, Hidetoshi Nagamasu at KYO, and Kunihiko Ueda at KANA, for generously permitting my access to the materials, and to two anonymous reviewers for helpful suggestions and corrections regarding my manuscript.

References

- Chen S.-C. 1980. *Chionographis*. In: Wang F. T. and Tang Ts. (eds.), *Flora Reipublicae Popularis Sinicae* **14**: 13–15. Science Press, Beijing (in Chinese).
- Hara H. 1968. A revision of the genus *Chionographis* (Liliaceae). *J. Jap. Bot.* **43**: 257–288, pls. 17, 18.
- Huang Y.-F., Jiang R.-H., Nong D.-X. and Xu W.-B. 2011. *Chionographis shiwandashanensis* sp. nov. (*Melanthiaceae*) from southern Guangxi, China. *Nordic J. Bot.* **29**: 605–607.
- Iinuma Y. and Makino T. 1907. *Sōmoku-dzusetsu*. Part

1. Herbaceous Plants (3rd. ed. with supplements), 1. Seibidō, Tokyo (in Japanese).

Krause K. 1929. Zwei für China neue Liliaceengattungen. Notizbl. Bot. Gart. Berlin-Dahlem **10**: 806–807.

Maki M. 1992. Fixation indices and genetic diversity in hermaphroditic and gynodioecious populations of Japanese *Chionographis* (Liliaceae). Heredity **68**: 329–336.

Maki M. 1993. Floral sex ratio variation in hermaphrodites of gynodioecious *Chionographis japonica* var. *kurohimensis* Ajima & Satomi (Liliaceae). J. Plant Res. **106**: 181–186.

Maximowicz C. J. 1867. Diagnoses breves plantarum novarum Japoniae et Mandshuriae 3. Bull. Acad. Imp. Sci. St.-Pétersb. **11**: 433–439.

Ohwi J. 1930. Symbolae ad floram Asiae orientalis. Bot. Mag. (Tokyo) **44**: 565–573.

Tanaka N. 1985. Shiraitosō zoku no seiteki hen-i [Sexual variation of the genus *Chionographis*], Shuseibutsugaku-kenkyū [Studies in Species Biology] **9**: 11–19 (in Japanese).

Tanaka N. 2003. New status and combinations for Japanese taxa of *Chionographis* (Melanthiaceae). Novon **13**: 212–215.

Yatabe R. 1893. Iconographia Flora Japonicae, **1**(3). Maruzen, Tokyo.

田中教之：紀伊半島産シライトイソウ属（シロソウ科）の1新種

紀伊半島（奈良県および三重県）の山岳地帯の渓谷時に岩稜にたいへん小型のシライトイソウ属の1種が生育している。本種はどの既知種とも一致しない特徴を持つことから新種と判定し、学名を *Chionographis cordifolia*、和名をキイヒメシライトイソウと名づけここに記載報告する。

本種の標本はこれまでシライトイソウ *C. japonica* またはチャボシライトイソウ *C. koidzumiana* と同定されてきた。しかし、本種はそのどちらとも一致しない。シライトイソウもチャボシライトイソウも6花弁のうち、下位の2片は通常退化的に存在するか、時にその一方もしくは双方が欠如しているが、本種の下位2片は常に存在するだけでなく、上位の花弁の半分ないし同じ位の長さがある。アズマシライトイソウ *C. hisauchiana* の花弁も常に6片あるが、下位の2片は上位のものの約半長である。キイヒメシライトイソウの薬は完全に1室で、この点はチャボシライトイソウに近いが、花弁はシライトイソウのように細いへら形をしている。葉身は小型で通常心臓形を呈する。成長した葉身が安定して心臓形ないしそれに近い形となるものは中国産種も含め他種には見られない特徴である。花茎上の中型の鱗片状葉もシライトイソウやチャボシライトイソウよりも相対的にやや小さい傾向がある。

キイヒメシライトイソウは上記のように独自のいくつかの特徴を持つことから、少なくとも、現存するよう

シライトイソウとチャボシライトイソウ間の交雑によって形成され、両親種の性質をそのまま保持しているだけの雑種ではない。

本種の花弁は長さがかなり近似しているが、このことは、花弁が著しく不等長であったり花弁数が減少している花を持つ日本産の他種よりもより祖先的（原始的）な性質であると解釈できる。他種を含めて、本種の系統由来の過程については今後さらに検討を要する。

本種の個体はシライトイソウの大部分のそれと同様に雄性両全性同株 (andromonoecism) ないし両全性 (hermaphroditism) の性型を表す。観察したほとんどの両性花の子房が果実化もしくはその兆しを示していた（ほぼ 100%）ことから、本種の個体は自家和合である可能性がある。このことも今後実験的に確かめる必要がある。

標本館に保管されている標本調査から、キイヒメシライトイソウの生育地の1箇所（奈良県）においては、シライトイソウの小型のものが近辺に生育しているようである。一見両者は似ているが、後者は下位の2片が退化的であることや、薬や葉の形質状態などで区別できる。

キイヒメシライトイソウの生育地は大変限られ個体数も少ないようなので、今後絶滅に追いやられることがないよう配慮が求められる。

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